

REMARKS

The Office Action of June 25, 2008, has been reviewed and the comments therein carefully considered. This application has been amended. In particular, Applicants have amended the specification to correct a translational error. No new matter has been added. Entry of this amendment is respectfully requested.

Claims 1-29 are pending in this application. Claims 1-11, 14, 15, and 18-29 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Pat. No. 6,773,803 to Lee et al. in view of U.S. Pat. App. Pub. No. 2004-0249012 to Tanaka et al. and further in view of Korean Publication No. 10-2003-0052373 to Kim et al.¹ and Japanese Publication No. 11-335596 to Taketoshi. This rejection is respectfully traversed. Claim 12, 13, 17, and 18 were objected to as depending upon a rejected base claim. Applicants presume that these objected-to claims contain allowable subject matter and thank the Examiner for such an indication.

This application is directed to a paint composition that exhibits far-infrared emissivity and antibiotic activity comprising, based upon 100 parts by weight thermosetting resin, 9-60 parts by weight ceramic powder and 0.2-4.0 parts by weight of phosphoric acid. The application is further directed to a pre-coated metal sheet coated with this paint composition.

In addition to having far-infrared emissivity and antibiotic activity, Applicants have discovered that a paint composition according to the current application also exhibits desirable levels of storage stability, solvent resistance, gloss and processability due, at least in part, to neutralization of the alkalinity of the ceramic powder through the use of phosphoric acid. Applicants' findings are exemplified in Table 1, which appears on pages 19 and 20 of the application as filed. As described in the background section of the application, conventional paint compositions use silica in relatively large amounts in order to decrease the alkalinity of conventional far infrared emitting ceramic powder materials. (Application, page 2). Examples of such conventional

¹ Kim was incorrectly identified as a Japanese Publication in the Office Action.

compositions are represented by, for example, comparative samples C.2 and C.3 in Table 1. In each of these samples, the processability is poor and the gloss value is quite low (17 and 21, respectively). Gloss is an important property for certain paint applications, and a high gloss value is necessary for paint compositions that are used for home appliances. By using phosphoric acid rather than silica to decrease the alkalinity of the ceramic powder material, Applicants have discovered a far-infrared emitting paint composition in which the alkalinity is neutralized without impairing other properties, such as the processability and gloss. Inventive examples I.1 through I.11, which each include phosphoric acid within the claimed amount, exhibit good processability and gloss values of 65 or more, among other desirable properties.

Lee (assigned to Posco, assignee of the present application) is directed to far-infrared emission powders, including powders of MgO , $\text{Mg}(\text{OH})_2$, ZnO , $\text{Zn}(\text{OH})_2$, CaCO_3 or mixtures thereof. (Lee, col. 5, lines 12-14). The emission powder can be used with a paint or resin system in amounts ranging from 5 to 100 parts by weight based on 100 parts by weight of the resin system. (Lee, col. 5, lines 61-64). Lee does not, however, disclose or suggest combining a thermosetting resin, a ceramic powder and a phosphoric acid.

Tanaka is directed to a water-based coating composition comprising a phosphoric acid ester having an ethylenically unsaturated double bond, an aqueous polyurethane resin and colloidal silica. (Tanaka, Abstract). In the Background section of Tanaka, it is suggested that several Japanese documents disclose a thermosetting resin in which adhesion is improved by adding a reaction product of an epoxy resin and phosphoric acid or an epoxy resin, phosphoric acid ester and carboxylic acid to an aqueous resin and an aqueous amino resin. (Tanaka, ¶ 0031). Nowhere in Tanaka, however, is it suggested to combine a thermosetting resin, phosphoric acid and a ceramic powder.

Kim (also assigned to Posco) is directed to ceramic powders having sterilization and far infrared emission. Taketoshi is also directed to a ceramics composition which exhibits far infrared emissivity and antibacterial properties. These

documents were not cited as disclosing, teaching or suggesting a ceramics composition having far infrared emissivity that includes phosphoric acid.

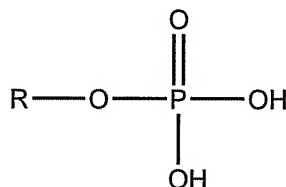
The Office Action contends that Applicants' invention consists of nothing more than the combination of old elements wherein no unexpected results are achieved. (Office Action, page 6). More specifically, the Office Action asserts, "it would have been obvious to one of ordinary skill in the art at the time of applicant's invention to employ phosphoric acid in the composition of Lee to derive their [phosphoric acid] usual adhesion enhancing properties." (Office Action, page 6). Applicants, however, respectfully disagree. The combination of a thermosetting resin, ceramic powder and phosphoric acid, in the amounts recited in the claims, to create a paint composition that exhibits far-infrared emissivity and antibiotic activity would not be obvious to one skilled in the art in view of the cited documents of record. Notably absent from the cited documents is any teaching or suggestion of the use of phosphoric acid in a far infrared emitting type composition. Further, this new combination of "old" elements represents a significant departure from conventional compositions which employ silica, rather than phosphorus acid, to control the alkalinity of a ceramic powder, and nothing in the cited documents suggests the desirability, or even feasibility, of instead using phosphoric acid. The significance of this distinction can be seen in the data compiled by Applicants in Table 1 and discussed above. By piecing together the individual components of Applicants' invention from multiple sources, without a justifiable rationale for doing so, the Office Action has engaged in improper hindsight reconstruction of the claims. Accordingly, Applicants respectfully submit that the claimed invention is not obvious in view of the cited documents of record and the rejections should be withdrawn.

Based on the cited documents of record, one skilled in the art would not have found it obvious to combine the resin of Tanaka with the ceramic powder composition of Lee. While Lee is based on a far infrared emissive ceramics composition, Tanaka is not. Instead, Tanaka is based on a curable coating composition for application to metal surfaces with improved adhesion properties. Further, the curable composition of Tanaka is a water based composition. (Tanaka, Abstract). Lee, on the

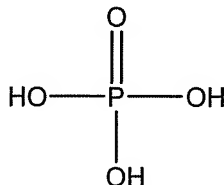
other hand, is directed to an organic solvent based paint composition. (Lee, col. 15, lines 3-6). Adding the ceramic powder of Lee, which has a high specific gravity, to the aqueous solution of Tanaka would result in the excess ceramic powder precipitating out of the solution causing problems in the storage and processability of the resultant composition. Accordingly, the combination of Lee and Tanaka is not a combination that would have been obvious to one skilled in the art.

Moreover, and perhaps more importantly, the combination proposed in the Office Action, combining the resin in Tanaka with the ceramic powder system of Lee, would not even result in the composition of claim 1 absent the significant, and unobvious, modification of Tanaka. As discussed above, claim 1 is directed to a paint composition comprising a thermosetting resin, ceramic powder and phosphoric acid in certain weight amounts. Lee discloses a ceramic powder which can optionally be combined with a resin. Tanaka discloses a resin composition which comprises phosphoric acid ester.

Applicants wish to clarify that a phosphoric acid ester, such as is disclosed in Tanaka, is significantly different than phosphoric acid, which is recited in the claim. A phosphoric ester has the following structure:

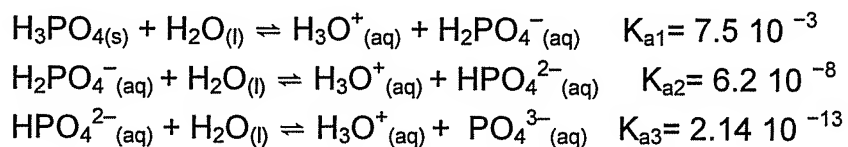


On the other hand, phosphoric acid has the following structure:



This structural difference amounts to an extremely significant distinction between the two compounds in terms of functionality, and specifically acidity. A phosphoric acid molecule can dissociate up to three times, giving up an H^+ each time and contributing to the acidity level of the surrounding composition. Meanwhile, a

phosphoric ester can dissociate only two times. The dissociation reactions of phosphoric acid, and the corresponding dissociation constants (K_a) are shown below²:



The $\text{p}K_{a1}$ of the first reaction shown above is 2.12, meaning that phosphoric acid $\text{H}_3\text{PO}_{4(s)}$ has a strong acidity. Meanwhile, the $\text{p}K_{a2}$ of the second reaction is 7.21, meaning that the acidity of H_2PO_4^- (equivalent to a phosphoric acid ester) is much less. A phosphoric ester is the reaction product of the esterification of phosphoric acid and alcohol. The most reactive OH group in phosphoric acid is reacted during esterification, and, thus, the reaction product of phosphoric ester does not have a strong acidity like a phosphoric acid. Therefore, phosphoric ester cannot control the pH of an alkaline and, unlike phosphoric acid, cannot neutralize or decrease the alkalinity of ceramic powder which, as mentioned above, is one object of Applicants' invention.

Because of these differences between phosphoric acid and phosphoric ester, the phosphoric ester in Tanaka would not have the same effect of neutralizing or decreasing the alkalinity of ceramic powders as the phosphoric acid recited in the claim. Consequently, substituting the resin of Tanaka, which includes a phosphoric acid ester, into the ceramic powder composition of Lee would not only fail to create a composition that includes phosphoric acid, but it would create a composition with a distinct and unique functionality, unlikely to provide the same desirable properties inherent in the claimed composition.

To account for this clear deficiency in Tanaka, the Office Action contends, based on Tanaka, it would be obvious to substitute a phosphoric ester with a phosphoric acid. However, this reasoning is also flawed. Tanaka only mentions phosphoric acid with respect to several Japanese documents discussed in the Background section and not made of record in this case. Allegedly, these Japanese

² Source: Wikipedia entry for "Phosphoric acid", http://en.wikipedia.org/wiki/Phosphoric_acid, (Oct. 22, 2008).

documents disclose a thermosetting composition in which adhesion is improved by adding the reaction product of an epoxy resin and phosphoric acid to an aqueous acrylic resin and an aqueous amino resin. (Tanaka, ¶ 0031). Applicants fail to see how this discussion teaches that the use of phosphoric acid is equated with the use of phosphoric ester for improving the adhesion of coating compositions. Rather, all that this limited discussion suggests, if anything, is that, with respect to a particular thermosetting resin, improved adhesive properties may be achieved by adding to an aqueous acrylic resin and an aqueous amino resin either: (A) the reaction product of an epoxy and a phosphoric acid or (B) the reaction product of an epoxy, phosphoric ester and carboxylic acid. Not discussed is how, why, or to what extent the adhesiveness is affected by using phosphoric acid instead of phosphoric ester. In fact, since the reaction involving phosphoric ester also requires a carboxylic acid, it could be said that this discussion teaches away from the chemical equivalence of phosphoric acid and phosphoric ester. Further, what is really involved is the reaction product of phosphoric acid with an epoxy. Applicants' invention is concerned with the use of phosphoric acid in a paint composition, not the use of the reaction product of phosphoric acid and an epoxy resin.

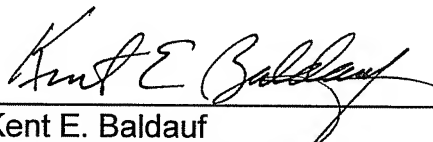
Applicants also fail to see how this teaching is relevant to the present situation in which Applicants have discovered that the use of a phosphoric acid to neutralize and control the alkalinity of ceramic powder provides advantageous results. Tanaka clearly fails to provide any suggestion as to the desirability of using phosphoric acid to control the alkalinity of a ceramic powder. Neither Tanaka nor the Japanese documents cited in the Background appear to even be concerned with ceramic powder compositions. Moreover, Tanaka's composition includes colloidal silica. (Tanaka, Abstract). Thus, even assuming one skilled in the art would find it obvious to combine Tanaka's resin with ceramic powders, which Applicants deny, there would be no motivation to use phosphoric acid to control alkalinity since the conventional alkaline controlling substance silica is already present. Only Applicants have discovered that a paint composition comprising a thermosetting resin, ceramic powder and phosphoric

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acid, in the recited amounts, can produce a paint composition having far-infrared emissivity, antibiotic activity and desirable processability, storage stability, and gloss.

For all of the foregoing reasons, Applicants submit that pending claims 1-29 are patentable over the cited documents of record and are in condition for allowance. Accordingly, reconsideration and withdrawal of the outstanding rejections and allowance of claims 1-29 are respectfully requested.

Respectfully submitted,
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